SCR2.0

Synchroscope and synch check relay

User manual - Technical documentation

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DOCUMENT CONTROL

Version	Date	Changed by	Details
A	July 22nd, 2014	A. Mesnard	First edition
B	Aug. 25th, 2014	A. Mesnard	Minor, chronogram completed

1 PRESENTATION

The unit SCR2.0 is a metering and control module used in manual synchronization and protection panels. It monitors the voltage and frequency of two power networks and shows the measured values on its 3-digit 7-segment display. The 24-led circular synchroscope indicates the true instantaneous phase angle between the networks.

It is powered by a battery.

It can check the synchronization between a generator and its busbar, or a generator busbar and mains.

The measured/calculated parameters are:

- Generator phase-to-neutral voltage
- Generator frequency
- Busbar phase-to-neutral voltage
- Busbar frequency
- Busbar-generator frequency difference
- Busbar-generator voltage difference
- Busbar-generator phase difference

⚠ WARNING
THIS UNIT DOES NOT CHECK THE PHASE SEQUENCE
First make sure the two AC supplies feature the same sequence of the phases
Failure to follow this instruction can damage the equipment

The unit is installer-friendly and user-friendly. In addition, programmable parameters give an extended control over the operation. The programmed values are stored in a non volatile memory; thus all information is retained even in the event of complete loss of power.

Designation: SCR 2.0 / A60 X2

2 INSTALLATION

The unit is designed for panel mounting, which provides user with access only to the front panel.

2.1 Environmental Requirements

- Operating temperature: -20°C (-4°F) to 70°C (158°F)
- Storage temperature: -30°C (-22°F) to 80°C (176°F)
- Maximum humidity: 95% without condensation

2.2 Unpacking

Make sure the packaging contains:

- the unit
- two clamping sets packaged apart
- a delivery bill

Unpack and keep the packaging in event of return.

Make sure the unit does not show scratches or visible defaults. Otherwise describe them on the bill.

2.3 Preparation

1. Cut out the panel to 92x92 mm minimum (3.6 in. x 3.6 in.)
2. Make sure the cut-out is smooth and clean

2.4 Mounting the Unit

Tool: cross-head screwdriver size 1.

To mount the unit:

3. Pass the unit through the panel
4. In the rear, insert the tab of a clamping set into the hole on one side of the unit, and screw the unit against the panel
5. Repeat on the other side
6. Tighten equally on both sides

2.5 Wiring the Unit

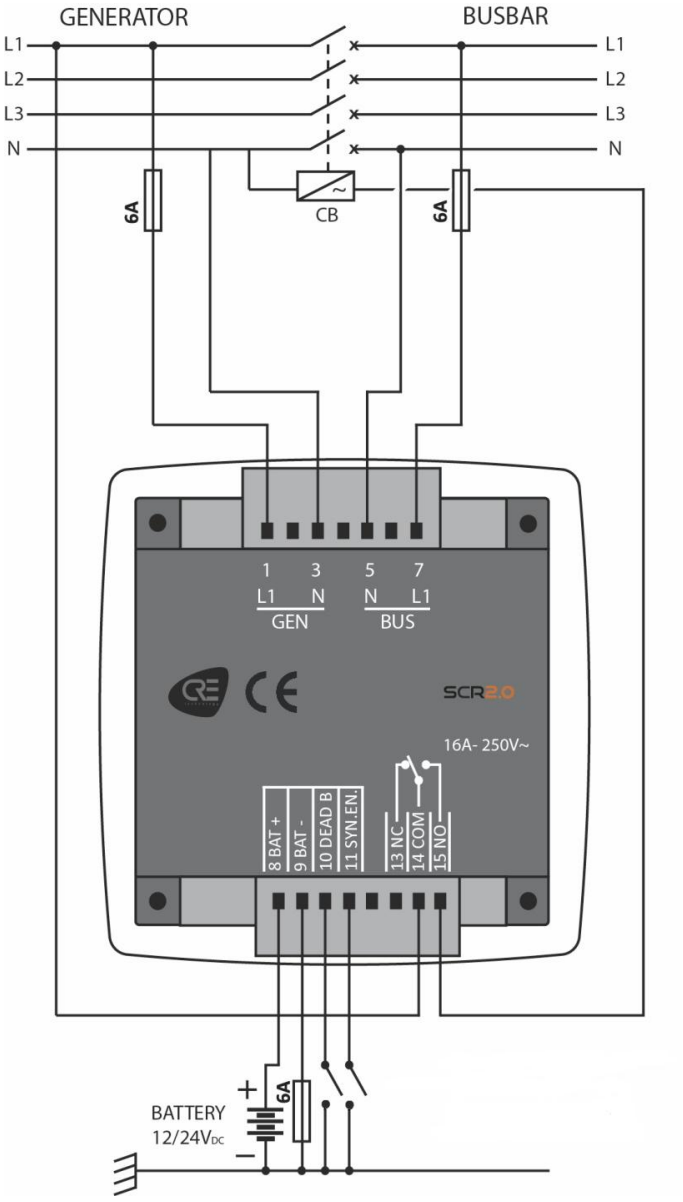
Tool: insulated screwdriver Ø2.5 mm (0.1 in.), tightening torque: 0.8 Nm (7 lb-in) max.

Wires: 0.2…2.5 mm² (AWG 25 …14)

Accessories: 7-terminal cable connector, protective gloves, carpet if the floor is wet

⚠ WARNING
THE UNIT IS NOT PROTECTED
Use external fuses for Busbar phase: L1, Generator phase: L1, Battery positive: BAT(+). Install the fuses as nearly as possible the unit, in a place easily accessible to the user. Fuse rating: 6A. The disconnection device must NOT be fitted in a flexible cord.
Failure to follow this instruction may damage the unit

⚠ DANGER	
	HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH ▪ The unit must only be installed and serviced by qualified electrical personnel ▪ Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices ▪ Turn off power before installing or removing fuses, and before installing the unit ▪ Use a properly rated voltage sensing device to confirm the power is off ▪ Do not use renewable link fuses in fused switch
	Failure to follow this instruction will result in death or serious injury



LOWER CONNECTOR: digital inputs and outputs, unit power supply

To check the connection, press the Lamp test button. (The led SYNCH OUT is not tested.)

UPPER CONNECTOR: phase L1 and neutral on both sides of the breaker

1. Make sure the cable connector is NOT plugged on the upper connector
2. Take on protective gloves
3. Connect the wires on the cable connector in accordance with the National Wiring Regulations

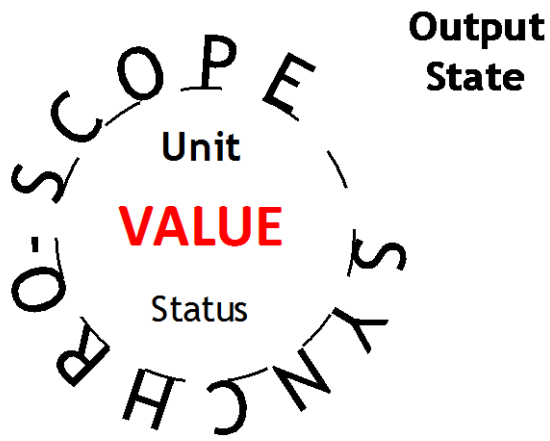
Term	Function	Technical data	Description
1	GENERATOR PHASE-L1	Generator phase input, 0-300VAC	Connect the generator phase there. The generator phase voltage upper and lower limits are programmable
2	unused		
3	GENERATOR NEUTRAL	Input, 0-300VAC	Neutral terminal of the generator phase
4	unused		
5	BUSBAR NEUTRAL	Input, 0-300VAC	Neutral terminal of the busbar phase
6	unused		
7	BUSBAR PHASE-L1	Busbar phase input, 0-300VAC	Connect the busbar phase there. The busbar voltage upper and lower limits are programmable

4. Plug the cable connector onto the upper connector
5. Lock the rear door.

⚠ DANGER	
	EXPOSED TERMINALS
	Do not touch or use non-insulated tools near terminals L1 and N. These terminals are unprotected and will expose the user to dangerous voltages
	Failure to follow this instruction will result in death, serious injury or equipment damage

3 HUMAN-MACHINE INTERFACE

The information is displayed as follows:



3.1 LED display

The Synchronoscope shows the instantaneous phase difference between the generator voltage and the busbar voltage.

- When both networks are synched, the uppermost led at 12:00, marked 0º, is ON
- When the generator frequency is higher than the busbar frequency, the synchroscope turns clockwise
- When the generator frequency is lower than the busbar frequency, the synchroscope turns counter-clockwise.

The Status shows the current status of the busbar and generator voltages and the synchronization checking status.

The SYNCH OUT illuminates when the SYNCH CHECK relay output is ON.

SCR 2.0 indicates the nature of the displayed value by lighting one unit led in three (VAC, Hz or degree).

LED	Colour	Description
Synchroscope	Red or amber	When both busbar and generator voltages are in range, the synchroscope illuminates. Only one of the leds turns on at a time. The led indicates the phase difference between the generator phase and the busbar phase. ▪ **Right**-hand side illuminated: the generator phase is leading (in advance) the busbar ▪ **Left**-hand side illuminated: the generator phase is lagging ▪ Light cycling clockwise: generator frequency > busbar frequency ▪ Light cycling **counter**-clockwise: generator frequency < busbar frequency
BUS status	Amber	ON when the busbar voltage is in range
GEN status	Amber	▪ OFF if the generator voltage is out of range ▪ Blinks if the generator voltage is in range, but SCR2.0 is waiting for a checking request ▪ Steadily ON if the synchronization coupling is enabled
Output state	Amber	ON when the SYNCH CHECK relay is energized. The synchronization checking can be initiated or terminated: ▪ locally by pressing the SYNCH button ▪ remotely via the SYNCHRONIZATION (CHECK) ENABLE input signal The led SYNCH OUT is not energized by the Lamp test
Unit	Red	SCR2.0 selects VAC, Hz or Deg. depending on the position in the MENU

3.2 Digital display

The unit has a three-digit seven-segment display. It shows on request:

- Readings (symbol, then value) in a sequence
- Programmable parameters (number, then value) in a sequence

Scan the various readings using the MENU button. The sequence is:

- U1: busbar phase-to-neutral voltage
- U2 : generator phase-to-neutral voltage
- dU: voltage difference between busbar and generator phases
- F1: busbar frequency
- F2: generator frequency
- dF: frequency difference between busbar and generator
- deg: phase difference between busbar and generator phases (degrees)

Hold down the button to display the value.

4 PROGRAMMING

⚠ WARNING
RISK OF UNINTENDED EQUIPMENT OPERATION
Set the parameters to values that do not endanger your setup. We strongly recommend to keep the parameter #9 to 1
Failure to follow this instruction can damage equipment

The program is used mainly to specify operational limits. To enter the program, press the MENU button for 5 seconds.

During programming, the unit still monitors and shows the statuses. Thus, the parameters can be modified anytime, even while the generator is running.

When the MENU button is pressed, the display shows the parameter number, when it is released the display shows the program parameter value. The first program number is “000”.

Press the MENU button to switch to next parameter. After the last parameter, the display cycles to the start.

Press the ⮝ / ⮟ keys to increase/decrease the value. Hold them down to increase/decrease the value by steps of 10 units.

The program display goes off automatically after 20 seconds if no button or key is pressed.

#	Definition	Unit	Typical	Status or description
0	Busbar Voltage Low Limit	V	100	Under this limit, the busbar voltage is invalid (out of range)
1	Busbar Voltage High Limit	V	500	Over this limit, the busbar voltage is invalid (out of range)
2	Gen. Voltage Low Limit	V	180	Under this limit, the generator voltage is invalid (out of range) Under this limit, the SYNCH CHECK relay cannot remain energized
3	Gen. Voltage High Limit	V	270	Over this limit, the generator voltage is invalid (out of range) Over this limit, the SYNCH CHECK relay cannot remain energized
4	Frequency difference	Hz	1.0	If the frequency difference between the busbar and the generator is above this limit, the synchronization is denied
5	Voltage difference	V	10	If the difference between the busbar and the generator voltages is above this limit, the synchronization is denied
6	Phase difference	deg	5	If the phase difference between the busbar and the generator voltages is above this limit, the synchronization is denied
7	Hysteresis Voltage	V	8	To prevent faulty decisions, you can set a hysteresis to the busbar and generator voltage limits. Recommended value: 8 V. For example, if the busbar voltage decreases, it goes out of range at P_000, whereas it returns in range at P_000 + P_007.
8	Synchronization checking delay	sec	3	Timer launched after the generator voltage is in range (set by parameters P_002 and P_003) and the synchronization checking is enabled. Refer to OTHER FEATURES.
9	Synchronization checking after coupling	-	1	0: the SYNCH CHECK relay remains energized **1: the unit continues to check the synchronization**

5 OPERATION

⚠ CAUTION
RISK OF ERRONEOUS MEASUREMENTS
Ground the engine body
Failure to follow this instruction result in incorrect measurements

5.1 Power-up

The unit is designed for continuous operation powered by the generator battery voltage (12/24VDC). It shuts off its displays after 1 mn if there is no voltage at the AC inputs and if no button is pressed.

It starts to monitor when a voltage is applied to either generator voltage input or busbar voltage input, or any front panel button is pressed.

The synchroscope illuminates if both generator and busbar phase voltages are in range. Otherwise it turns off to prevent the display of worthless information.

5.2 Status information

Refer to HUMAN-MACHINE INTERFACE.

5.3 Synchronization checking

The synchronization checking is ordered

- either locally by pressing the SYNCH button
- or remotely via the input signal SYNCHRONIZATION (CHECK) ENABLE

Then, the unit is allowed to close the relay output if the networks are synched.

Otherwise it does not close the relay even if the networks are synched.

For a quick checking after the generator start, connect the SYNCHRONIZATİON (CHECK) ENABLE input signal to the battery negative. To let the generator stabilize (or even heat up if needed), program a pre-synchronization delay (P_08). Refer to Synchronization checking delay.

The synchronization checking is not timed. The unit continues checking the synchronization until the conditions are met or the process terminated with the SYNCH button or the SYNCHRONIZATION (CHECK) ENABLE signal.

A closed to open transition on the SYNCHRONIZATION CHECK ENABLE input causes the SYNCH RELAY to de-energize and the synchronization checking to terminate.

Positions:

Sync En. Contactor	SYN. EN.
closed	activated
open	de-activated

Once the SYNCH CHECK relay is energized, the synchronization checking goes on depending on the parameter P_09. **Set it to 1**. It is of the responsibility of the panel builder to use a quickly closing circuit breaker.

On 0, the synchronization checking is disabled after closing the SYNCH CHECK relay, the relay output remains energized even though the circuit breaker fails to close.

Term	Function	Data	Description
8	BATTERY POSITIVE	+12 or 24VDC (9.0 … 33.0 V)	Positive terminal of the DC supply. The unit operates on both 12V and 24V battery systems.
9	BATTERY NEGATIVE	0VDC	Power supply negative connection.
10	DEAD BUS ENABLE	Input	If the signal is active, the unit is allowed to energize the relay output even though the voltage level at the busbar input is below the set limit. Refer to OTHER FEATURES. To set the limit, refer to PROGRAMMING.
11	SYNCHRON. (CHECK) ENABLE	Input	If the signal is active, the unit is allowed to close the relay output when the conditions are met. Otherwise it does not energize the relay.
12	unused		
13	SYNCH CHECK RELAY normally closed	Breaking capacity: 16A/ 250VAC	These outputs energize the circuit breaker. If the generator voltage is out of range, or if the voltage, frequency or phase differences between generator and busbar are not in range, it is not energized. If the busbar is not powered up, use the DEAD BUS ENABLE input signal. Refer to OTHER FEATURES.
14	SYNCH CHECK RELAY common		
15	SYNCH CHECK RELAY normally open		

The unit checks the synchronization only when both generator and busbar phase voltages are in range and the synchronization is enabled either with the SYNCH (CHECK) ENABLE signal or the SYNCH button.

If both busbar and generator phase voltages are in range, the synchroscope illuminates. The synchroscope shows the phase difference between busbar and generator.

The synchronization checking is the verification of the following conditions:

- the busbar phase voltage lies between limits set by P_00 and P_01
- the generator phase voltage lies between limits set by P_02 and P_03
- the frequency difference between the busbar and generator does not exceed the limit set by P_04
- the voltage difference between the busbar and generator does not exceed the limit set by P_05
- the phase difference between the busbar and generator does not exceed the limit set by P_06

If they are met for 4 consecutive busbar cycles, the SYNCH CHECK relay is immediately energized.

6 OTHER FEATURES

6.1 Dead Bus Enable

It may be required to couple a generator to an unpowered bus (dead bus). This is especially the case for multi-generator synchronization systems, where one of the generators must feed the busbar to serve other generators as a reference for synchronization.

When active, the DEAD BUS ENABLE input signal causes SCR2.0 to energize the SYNCH CHECK relay when all the following conditions are met:

- synchronization checking requested (either via input or button)
- the generator phase voltage is within limits set by P_02 and P_03
- the busbar voltage is below the limit set by P_00.

If the busbar voltage is above this limit, the SYNCH CHECK relay output is not energized even if the DEAD BUS ENABLE signal is active.

Positions:

Dead bus Contactor	DEAD BUS
closed	activated
open	de-activated

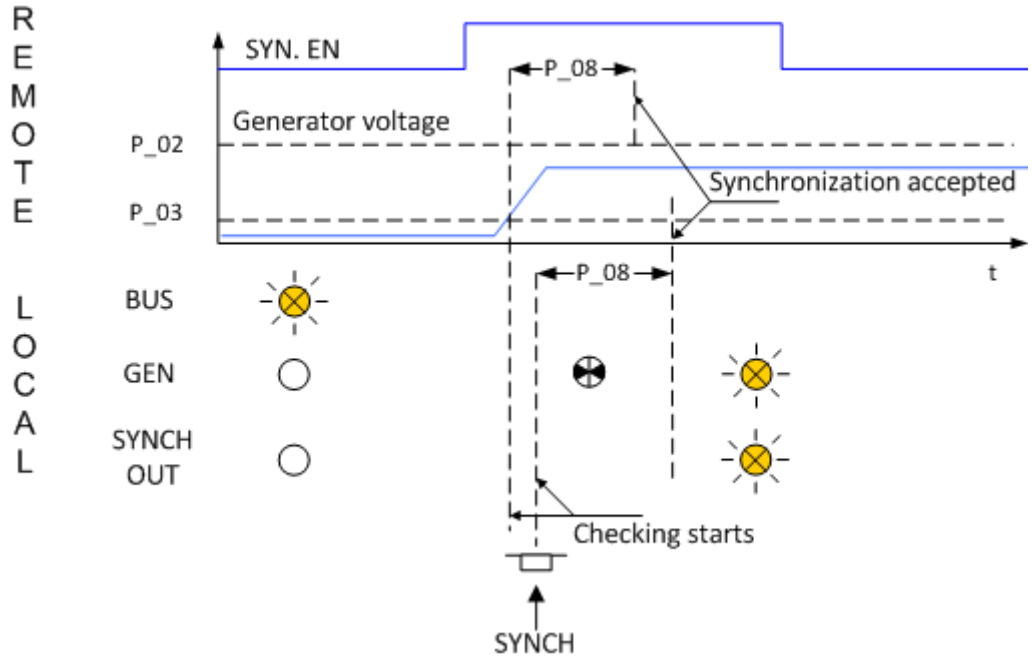
6.2 Synchronization checking delay

To let the generator stabilize (or even heat up if needed), program a pre-synchronization delay (P_08).

When the generator voltage is in range, the unit is allowed to run this delay; at expiry, the synchronization checking can be accepted.

Default factory setting: 3 seconds. If no delay is requested, set the parameter to 0.

Example of remote/local request of synchronization checking:



7 MISCELLANEOUS

7.1 Troubleshooting

AC voltages or frequency displayed on the unit are not correct (voltage accuracy: ± 3 V):

- Check the proper engine body grounding
- If there are faulty measurements only when the engine is running, there may be a faulty charging alternator or voltage regulator on the engine. Disconnect the charging alternator connection of the engine and check if the error persists
- If there are faulty measurements only when mains are present, the battery charger may be failed. Turn off the battery charger fuse and check.

The unit is inoperative:

- The unit may be in sleep mode. Press any button to wake it up

⚠ DANGER	
	EXPOSED TERMINALS
	Do not touch or use non-insulated tools near terminals L1 and N. These terminals are unprotected and will expose the user to dangerous voltages
	Failure to follow this instruction will result in death, serious injury or equipment damage

- Measure the DC supply voltage between terminals 8 and 9 at the rear of the unit. If they are in range, turn all the fuses off, then turn all the fuses on, starting from the DC supply fuse. Finally test the unit again. Lock the rear door.

The digital display test shows only 1: check the power supply.

If you return the unit, attach an RMA (available on the website).

7.2 Declaration of conformity

The unit conforms to the following EEC directives

- 73/23/EEC and 93/68/EEC (low voltage)
- 89/336/EEC, 92/31/EEC and 93/68/EEC (electro-magnetic compatibility)

Standards:

- EN 61010 (safety requirements)
- EN 50081-2 (EMC requirements)
- EN 50082-2 (EMC requirements)

The CE mark indicates that this product complies with the European requirements for safety, health, and environ- mental and user protection.

7.3 Technical specifications

Features:

- 24-led circular synchroscope
- Programmable ΔV, Δf, Δθ and parameters
- Front panel programming

- Voltage inputs: 1 phase of generator and 1 phase of busbar
- Synch check & dead bus enable input
- Auto power off
- Plug-in connection system for easy replacement

Measurements:

- Busbar voltage: 300 VAC max. (Ph-N)
- Busbar frequency: 50/60 Hz
- Generator voltage: 300 VAC max. (Ph-N)
- Generator frequency: 0-100 Hz

Other electrical data:

- Digital inputs: 0V (active inputs), withstand 30VDC
- DC Supply Range: 9.0 to 33.0 VDC
- Current Consumption: 100 mA (standby), 150 mA (all LEDs lit, Synch Check relay de-energized)
- Synch Check relay breaking capacity: 16 A / 250VAC

Casing:

- Dimensions: 102x102x57 mm (4 in. x 4 in. x 2.3 in.) (width x height x in-panel depth)
- Mounting: Front panel
- Weight: 170 g (approx.)
- Material: High temperature ABS (UL94-V0, 100°C)
- Protection: IP65 from front panel, IP30 from the rear

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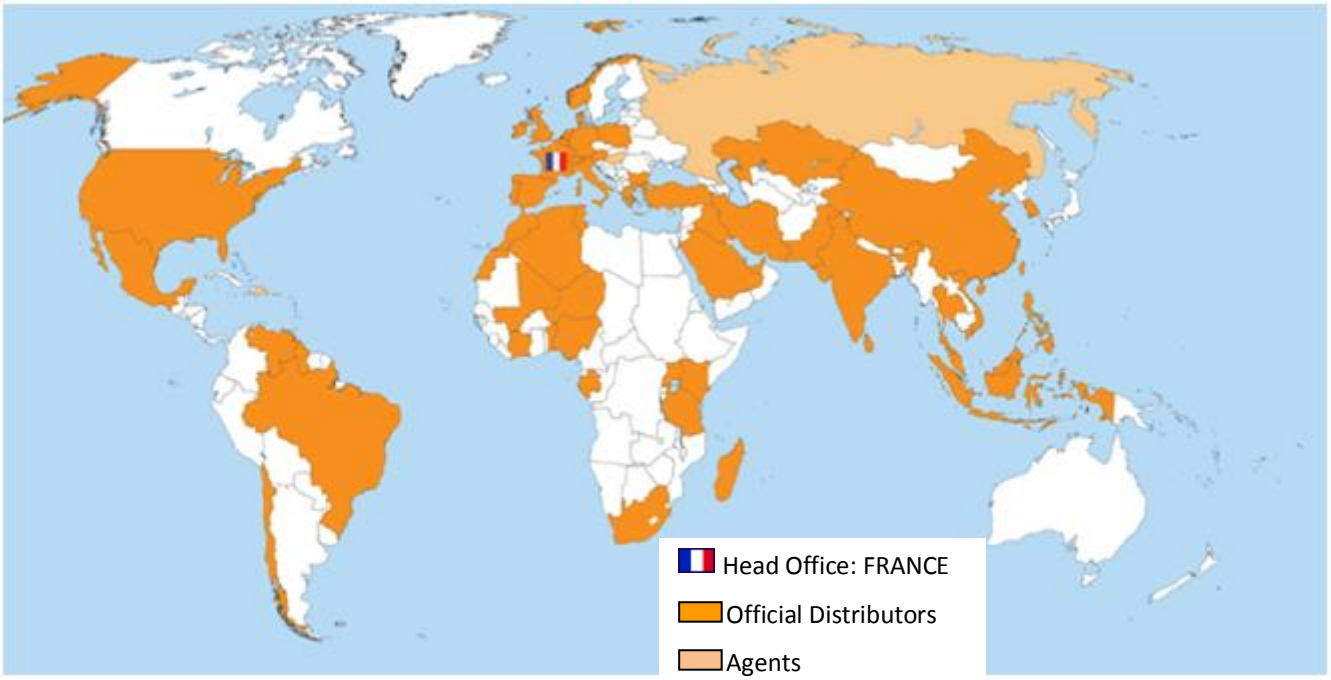

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